Appendix B

Wikipedia Article Describing Presbyopia

Presbyopia

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Presbyopia is a health condition where the eye exhibits a progressively diminished ability to focus on near objects with age. Presbyopia's exact mechanisms are not known with certainty; the research evidence most strongly supports a loss of elasticity of the crystalline lens, although changes in the lens's curvature from continual growth and loss of power of the ciliary muscles (the muscles that bend and straighten the lens) have also been postulated as its cause.

Presbyopia	
Classification and external resources	
ICD-10	H52.4
ICD-9	367.40
MeSH	D011305

Similar to grey hair and wrinkles, presbyopia is a symptom caused by the natural course of aging. The first symptoms (described below) are usually first noticed between the ages of 40-50. The ability to focus on near objects declines throughout life, from an accommodation of about 20 dioptres (ability to focus at 50 mm away) in a child, to 10 dioptres at 25 (100 mm), and levels off at 0.5 to 1 dioptre at age 60 (ability to focus down to 1-2 meters only).

The word *presbyopia* comes from the Greek word *presbys* (πρέσβυς), meaning "old man" or "elder", and Latin root *-opia*, meaning "eye"[1])

Contents

Symptoms

The first symptoms most people notice are difficulty reading fine print, particularly in low light conditions, eyestrain when reading for long periods, blur at near or momentarily blurred vision when transitioning between viewing distances. Many extreme presbyopes complain that their arms have become "too short" to hold reading material at a comfortable distance.[2]

Presbyopia, like other focus defects, becomes much less noticeable in bright sunlight. This is a

result of the iris closing to a smaller diameter. As with any lens, increasing the focal ratio of the lens increases depth of field by reducing the level of blur of out-of-focus objects (compare the effect of aperture on depth of field in photography).

A delayed onset of seeking correction for presbyopia has been found among those with certain professions and those with miotic pupils.[3] In particular, farmers and homemakers seek correction later, whereas service workers and construction workers seek eyesight correction earlier.

Focusing mechanism of the eye

In optics, the closest point at which an object can be brought into focus by the eye is called the eye's **near point**. A standard near point distance of 25 cm is typically assumed in the design of optical instruments, and in characterizing optical devices such as magnifying glasses.

There is some confusion in articles and even textbooks over how the focusing mechanism of the eye actually works. In the classic book, 'Eye and Brain' by Gregory, for example, the lens is said to be suspended by a membrane, the 'zonula', which holds it under tension. The tension is released, by contraction of the ciliary muscle, to allow the lens to fatten, for close vision. This would seem to imply that the ciliary muscle, which is outside the zonula must be circumferential, contracting like a sphincter, to slacken the tension of the zonula pulling outwards on the lens. This is consistent with the fact that our eyes seem to be in the 'relaxed' state when focusing at infinity, and also explains why no amount of effort seems to enable a myopic person to see further away. Many texts, though, describe the 'ciliary muscles' (which seem more likely to be just elastic ligaments and not under any form of nervous control) as pulling the lens taut in order to focus at close range.[*citation needed*] This has the counter-intuitive effect of steepening the lens valve cytokinesis centrally (increasing its power) and flattening peripherally.

Interaction with myopia

Many people with myopia (near-sightedness) can read comfortably without eyeglasses or contact lenses even after age 40. However, their myopia does not disappear and the long-distance visual challenges remain. Myopes considering refractive surgery are advised that surgically correcting their nearsightedness may be a disadvantage after age 40, when the eyes become presbyopic and lose their ability to accommodate or change focus because they will then need to use glasses for reading. Myopes with astigmatism find near vision better, though not perfect, without glasses or contact lenses when presbyopia sets in, but the more astigmatism the poorer their uncorrected near vision.

A surgical technique offered is to create a "reading eye" and a "distance vision eye", a technique commonly used in contact lens practice, known as monovision. Monovision can be created with contact lenses or spectacles so that candidates for this procedure can determine if they are prepared to have their corneas reshaped by surgery to cause this effect permanently.

Treatment

Since it is a natural part of the human aging process, presbyopia is not routinely curable. Treatment for presbyopia has advanced significantly in recent years, thanks in no small part to the ready availability of inexpensive over-the-counter reading glasses with corrective lenses that

cover a wide gamut of magnification levels. Contact lenses have also been used to correct the focusing loss that comes along with presbyopia. Some people choose to correct the focus problems with bifocals, giving them a wider range of vision without having to use a second set of glasses. As the focusing loss increases, prescription changes become more frequent.

In order to reduce the need for bifocals or reading glasses, some people choose contact lenses to correct one eye for near and one eye for far with a method called "monovision", which can interfere with depth perception due to loss of focusing ability in the other eye. There are also newer bifocal or multifocal contact lenses that attempt to correct both near and far vision with the same lens.[4]

Controversially, eye exercises have been touted as a way to delay the onset of presbyopia,[5] but there is no evidence that they work.[6]

Surgery

New surgical procedures may also provide solutions for those who do not want to wear glasses or contacts, including the implantation of accommodative intraocular lenses (IOLs). Scleral expansion bands, which increase the space between the ciliary body and lens, have not been found to provide predictable or consistent results in the treatment of presbyopia.[7] INTRACOR [8] has now been approved in Europe for treatment of both eyes (turning both corneas into multifocal lenses and so dispensing with the need for reading glasses).

PresbyLASIK, Conductive Keratoplasty, AcuFocus[9] are also worth consideration, but some use of reading glases will still remain when light is poor, or when reading for extended periods of time.

Another treament option for the correction of presbyopia in patients with emmetropia as well as in patients with myopia, hyperopia and astigmatism is Laser Blended Vision. In Laser Blended Vision, laser refractive surgery is used to correct the dominant eye mainly for distance vision and the non-dominant eye mainly for near vision, while the depth of field (i.e the range of distances at which the image is in focus) of each eye is increased. As a result of the increased depth of field, the brain merges the two images, creating a blend zone, i.e a zone which is in focus for both eyes. This allows the patient to see near, intermediate and far without glasses.[10] [11] [12]

See also

- Conductive Keratoplasty
- PresbyLASIK
- Laser Blended Vision
- Eye examination
- Astigmatism (eye)
- Eyeglass prescription, especially the section on Distant vision and near vision.
- Hyperopia
- Corrective lens
- Lens (optics)
- Myopia
- Ophthalmology
- Optician

- Optometry
- Orthoptics

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External links

- Presbyopia
- Vision Over 40
- Presbyopia at MedLinePlus Medical Encyclopedia
- Binocular Presbyopia Diagnosis with Dynamic Stimulation Aberrometry
- Ray Gottlieb, O.D., Ph.D. "Presbyopia Reduction" (PDF). http://www.i-see.org/gottlieb/presbyopia_chart.pdf. Retrieved 5 July 2009.—Chart with exercise proposed to reverse presbyopia.

Retrieved from "http://en.wikipedia.org/wiki/Presbyopia"
Categories: Eye | Optometry | Disorders of ocular muscles, binocular movement, accommodation and refraction

Appendix C

Wikipedia Article Describing Astigmatism

Astigmatism (eye)

From Wikipedia, the free encyclopedia

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Astigmatism	
Classification and external resources	
ICD-10	H52.2
ICD-9	367.2

Astigmatism is an optical defect in which vision is blurred due to the inability of the optics of the eye to focus a point object into a sharp focused image on the retina. This may be due to an irregular or toric curvature of the cornea or lens. There are two types of astigmatism: regular and irregular. Irregular astigmatism is often caused by a corneal scar or scattering in the crystalline lens and cannot be corrected by standard spectacle lenses, but can be corrected by contact lenses. Regular astigmatism arising from either the cornea or crystalline lens can be corrected by a toric lens. A toric surface resembles a section of the surface of an American football or a doughnut where there are two regular radii, one smaller than another. This optical shape gives rise to regular astigmatism in the eye.[1] The first spectacle lenses that corrected astigmatism were made in Philadelphia in 1841.

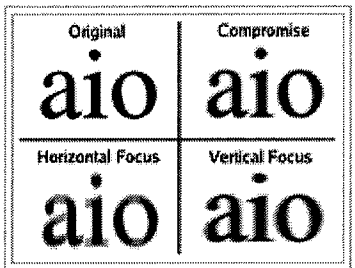
The refractive error of the astigmatic eye stems from a difference in degree of curvature refraction of the two different meridians (i.e., the eye has different focal points in different planes.) For example, the image may be clearly focused on the retina in the horizontal (sagittal) plane, but not in the vertical (tangential) plane. Astigmatism causes difficulties in seeing fine detail, and in some cases vertical lines (e.g., walls) may appear to the patient to be tilted. The astigmatic optics of the human eye can often be corrected by spectacles, hard contact lenses or contact lenses that have a compensating optic, cylindrical lens (i.e. a lens that has different radii of curvature in different planes), or refractive surgery.

Contents

Types

Based on axis of the principal meridians

- Regular astigmatism – principal meridians are perpendicular
  - With-the-rule astigmatism – the vertical meridian is steepest (an American football lying on its side).[2]
  - Against-the-rule astigmatism – the horizontal meridian is steepest (an American football standing on its end).[2]
  - Oblique astigmatism – the steepest curve lies in between 120 and 150 degrees and 30 and 60 degrees.[2]
- Irregular astigmatism – principal meridians are not perpendicular



Blur from astigmatic lens at different distances.

Also known as Murdoch Syndrome (Ref: glastonbury Medics)

In With-the-rule astigmatism, the eye sees vertical lines more sharply than horizontal lines. Against-the-rule astigmatism reverses the situation. In With-the-rule astigmatism a minus cylinder is placed in the horizontal axis to correct the refractive error. Adding a minus cylinder in the horizontal axis makes the horizontal axis "steeper" which makes both axes equally "steep." In Against-the-rule astigmatism a plus cylinder is added in the vertical axis.

Children tend to have With-the-rule astigmatism and adults tend to have Against-the-rule astigmatism.

Axis is always recorded as an angle in degrees, between 0 and 180 degrees in a counter-clockwise direction. 0 and 180 lie on a horizontal line at the level of the centre of the pupil, and as seen by an observer, 0 lies on the right of both eyes.

Based on focus of the principal meridians

- Simple astigmatism
  - Simple hyperopic astigmatism – first focal line coincides with the retina while the second is located behind the retina
  - Simple myopic astigmatism – first focal line is located in front of the retina while the second focal line is located on the retina
- Compound astigmatism
  - Compound hyperopic astigmatism – both focal lines are located behind the retina
  - Compound myopic astigmatism – both focal lines are located in front of the retina
- Mixed astigmatism – focal lines are on both sides of the retina (straddling the retina)

Prevalence

According to an American study published in *Archives of Ophthalmology*, nearly 3 in 10

children between the ages of 5 and 17 have astigmatism [3]. A recent Brazilian study found that 34% of the students in one city were astigmatic[4]. Regarding the prevalence in adults, a recent study in Bangladesh found that nearly 1 in 3 (32.4%) of those over the age of 30 had astigmatism [5].

A recent Polish study revealed that "with-the-rule astigmatism" may lead to the onset of myopia [6].

A number of studies have found that the prevalence of astigmatism increases with age[7].

Diagnosis

Symptoms

Although mild astigmatism may be asymptomatic, higher amounts of astigmatism may cause symptoms such as blurry vision, squinting, asthenopia, fatigue, or headaches.[8][9][10]

Signs and tests

There are a number of tests used by ophthalmologists and optometrists during eye examinations to determine the presence of astigmatism and to quantify the amount and axis of the astigmatism. [11] A Snellen chart or other eye charts may initially reveal reduced visual acuity. A keratometer may be used to measure the curvature of the steepest and flattest meridians in the cornea's front surface.[12] Corneal topography may also be used to obtain a more accurate representation of the cornea's shape.[13] An autorefractor or retinoscopy may provide an objective estimate of the eye's refractive error and the use of Jackson cross cylinders in a phoropter may be used to subjectively refine those measurements.[14][15] [16]. An alternative technique with the phoropter requires the use of a "clock dial" or "sunburst" chart to determine the astigmatic axis and power. [17][18] A keratometer may also be used to estimate astigmatism by finding the difference in power between the two primary meridians of the cornea. Javal's rule can then be used to compute the estimate of astigmatism.

Another refraction technique that is rarely used involves the use of a stenopaic slit (a thin slit aperture) where the refraction is determined in specific meridians - this technique is particularly useful in cases where the patient has a high degree of astigmatism or in refracting patients with irregular astigmatism.

Treatment

Astigmatism may be corrected with eyeglasses, contact lenses, or refractive surgery. Various considerations involving ocular health, refractive status, and lifestyle frequently determine whether one option may be better than another. In those with keratoconus, rigid gas permeable contact lenses often enable patients to achieve better visual acuities than eyeglasses. If the astigmatism is caused by a problem such as deformation of the eyeball due to a chalazion, treating the underlying cause will resolve the astigmatism. Should the person suffer from severe or irregular corneal astigmatism, they may be advised to wear rigid gas permeable contact lenses rather than the more comfortable soft contact lenses as this has the effect of masking the

astigmatism.

See also

Related conditions

- Hyperopia
- Keratoconus
- Myopia
- Presbyopia

Other

- Eyeglass prescription
- Refractive surgery
- Lens (optics)
- Ophthalmology
- Optician
- Optometry

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External links

- Astigmatism (eye) at the Open Directory Project

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